Unmanned Systems Antennas

Airborne Platforms, UAVs, Ground Vehicles, Robots

Designed to the highest specification

Critical and efficient communications

Control links and robotics

Antennas used worldwide on all types of unmanned airborne vehicles and target drones

Unmanned Systems Antennas

Airborne Platforms, UAVs, Ground Vehicles, Robots

Unmanned helicopter

Blade, Omni, Directional and Sector Antennas

Unmanned Vehicle Antennas

Unmanned Systems (UMS) are providing an increasing number of operational functions including airborne and remote ground surveillance, video transmission, border patrol and tactical systems. Uninterrupted communication to the control centre is vital.

As the demand for Unmanned Systems increases, so does the need for a wider range of antennas for payloads, data communications systems, command and control.

Performance requirements and cost criteria are an important consideration when selecting the antenna. Chelton have a range of standard cost-effective, entry-level, high performance antenna designs that are already used on Unmanned Systems.

As frequencies increase from L-band to Ku-band to provide wider bandwidths enabling higher data rates, the antenna selection is critical to ensure system performance, battery-life and transmission range.

Ground Control Centre Antennas

Chelton provide antennas for both control centre and remote platform.

The control centre antenna usually provides the higher gain part of the link and may be a medium to high gain omni, medium gain sector or a high gain directional antenna.

A directional antenna is likely to require a two-axis steering system. A less complex but compact multi-sector antenna array provides intermediate range coverage for communicating with a UAV. This type of arrangement can be used for quick deployment, tactical applications.

Chelton have a range of multi-sector and multi-omni arrays. See separate brochure.

Cranfield Aerospace Prototype Boeing X-48B Blended Wing Body UAV

Cranfield Aerospace built two complete working prototypes of the X-48B BWB, an unmanned airborne scale model, which is a joint venture between Boeing Research & Technology, NASA and the US Air Force Research Laboratory.

After 80 flights, the X-48B is demonstrating that the BWB can be designed to overcome the challenges of low speed flight.

The blade antennas weigh less than 20 grams, are robust, weatherproof and measure 105x30x2mm. Mounted on a cross spar, each antenna covers a different frequency and is part of the telecommand, telemetry and AV systems.

SBA-1480/1297	SBA-1790/1298	SBA-2295/1299
1.43 - 1.52 GHz	1.75 - 1.82 GHz	2.20 - 2.39 GHz

- High gain, vertically polarised omni antennas are installed in aerodynamic foil structures
- Common Data Link (CDL) Ku-band omni antennas have circular polarisation and up to 4dBiC gain
- Directional antennas for communications between an airborne towed target and the towing aircraft
- Radar cross-section enhancement and radar detection
- Pattern data is available for all antennas
- Development projects undertaken

Swedish Space Corporation science gondola and balloon

The scientific instrument MIPAS/B-Tellis was launched from the Esrange Space Center in northern Sweden, reached a height of 34km and landed after 14 hours in eastern Finland. The rugged antenna EVD2-1450/124 mounted beneath the gondola and completely exposed, helped provide scientists with the data required.

EVD2-1450/124 (page 4)

Remote UAV or UGV Platforms

Omni and Blade Antennas

Predator UAV

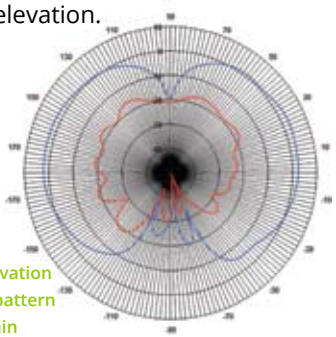
Unmanned Vehicle Antennas

The antennas that are used on unmanned vehicles are, in general, rugged, flexible dipole or blade antennas with omni-directional coverage. Directional blade antennas have been developed for specialist applications. Standard flange mounting arrangements are available, however special mounting arrangement can be designed. Durable and robust, every effort is made to ensure the antenna meets the required specification to avoid link breakdown.
See page 7 for information on polarisation mismatch.

Omni - Rugged Dipole

Rugged dipoles typically have N-type (F) connectors.

Monopole and dipole antennas have a 360° coverage in azimuth and typically 80° coverage in elevation.



Typical elevation radiation pattern for 2dBi gain dipole

EVD2-3.2/1401 (page 5)

Omni - Slim Flexible Dipole

Traditional dipole antennas have omni-directional coverage, being either slim, rugged, or flexible. Monopole and dipole antennas have a 360° coverage in azimuth and typically 80° coverage in elevation.

- Dipole Antennas
- Omni coverage
- Vertical polarisation
- Gain 2dBi with elevation HPBW 80°
- Frequencies 300MHz to 12GHz
- SVD2 are slim and semi rigid, with an abrasion resistant rubberised coating; most have SMA connectors
- EVD2 rugged dipoles have rigid glass fibre radome; most have N-type connectors

SVD2-3450/426 (page 5)

Blade - Omni Directional

- Blade antennas can be as little as 2mm thick
- Aerodynamic
- They may be housed in protective radomes
- Light weight
- Specification as for dipole antenna
- Coverage can be omni-directional or directional

Left to right

SBA-2.3V/1470 (page 5)

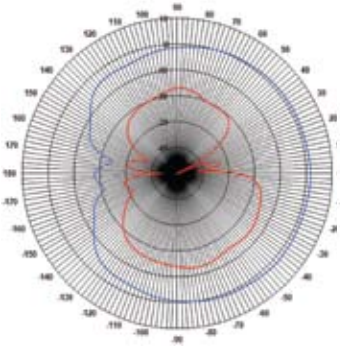
SBA-900/1249 (page 4)

Blade - Directional

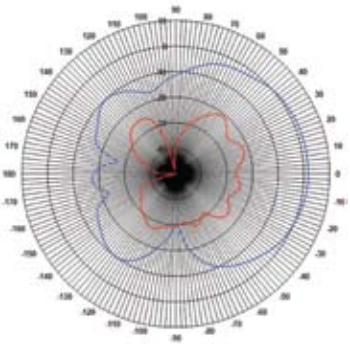
Blade antennas suitable for integration into airborne systems.

Wing-tip design for airborne comms HDA-1275/1148 (page 4)

Typical azimuth pattern for HDA



Typical elevation pattern for HDA



Unmanned Vehicle Antennas

Remote UAV or UGV Platform Omni and Blade Antennas

Talon at work

Omni antenna
VOA4-918/052

Vertically polarised omni antenna with flange
VOA4-1400/1130

Part Number	Frequency GHz	Gain dBi	Beamwidth Azimuth°	Elevation°	Polarisation	Dimensions mm	Connector	Photo p
Antennas - Omni less than 1GHz								
EVD2-320/116	0.31 - 0.32	2	360	80	Vertical	584x25 Ø	N(F)	
SBA-0.4V/1469	0.41 - 0.43	2	360	80	Vertical	40x40x171	SMA(F)	
SVD2-915/432	0.87 - 0.96	2	360	80	Vertical	155x12 Ø	SMA(M)	
EVD2-915/260	0.87 - 0.96	2	360	80	Vertical	248x25 Ø	N(F)	
VOA4-918/052	0.87 - 0.96	4	360	40	Vertical	705x57 Ø	N(F)	above
VOA4-918/1318	0.87 - 0.96	4	360	40	Vertical	705x57 Ø	N(F)	
SBA-900/1249	0.90 - 0.93	2	360	100	Vertical	98x77x44 Ø	TNC(F)	page 3
Antennas - Omni 1GHz to 2GHz								
HDA-1275/1148	1.20 - 1.35	4	75	175	Horizontal	120x74x1	SMA(M) 90°∞	page 3
VOA4-1270/037	1.22 - 1.32	4	360	40	Vertical	658x57 Ø	N(F)	
SVD2-1270/074	1.24 - 1.30	2	360	80	Vertical	212x19 Ø	N(M)	
EVD2-1300/018	1.24 - 1.34	2	360	80	Vertical	241x25 Ø	N(F)	
EVD2-1300-N(M)/1214	1.24 - 1.34	2	360	80	Vertical	240x14 Ø	N(M)	
EVD2-1300-short/019	1.24 - 1.38	2	360	80	Vertical	170x25 Ø	N(F)	
EVD2-1300/1395	1.27 - 1.35	2	360	70	Vertical	220x45 Ø	N(F)	p
SVD2-1.4V/1396	1.29 - 1.41	2	360	80	Vertical	174x11 Ø	SMA(M)	
VOA7-1373/361	1.33 - 1.41	7	360	20	Vertical	905x57 Ø	N(F)	
EVD2-1400-NM/1264	1.35 - 1.43	2	360	80	Vertical	222x26 Ø	N(M)	
SVD2-1304-SMA(M)/1307	1.35 - 1.43	2	360	80	Vertical	190x11 Ø	SMA(M)	
EVD2-1400/1340	1.35 - 1.45	2	360	80	Vertical	207x29 Ø	N(F)	p
EVD2-1400/329	1.35 - 1.45	2	360	80	Vertical	258x13 Ø	N(F)	p
SVD2-1.4V/1443	1.35 - 1.45	2	360	80	Vertical	200x21 Ø	N(M)	
EVD2-1400-D1/1248	1.35 - 1.45	2	360	80	Vertical	220x45 Ø	N(F)	p
OA4-1.4V/1483	1.36 - 1.55	5	360	40	Vertical	525x57 Ø	N(F)	p
VOA4-1400/1130	1.37 - 1.40	3	360	50	Vertical	360x150 Ø	N(F)	above

EVD2-1300/1395

EVD2-1400/1340

EVD2-1400/329

EVD2-1400-D1/1248

OA4-1.4V/1483

EVD2-1.5V/1646

EVD2-1450/124	1.40 - 1.50	2	360	60	Vertical	258x14 Ø	N(F)	page 2
EVD2-1.5V/1646	1.40 - 1.525	2	360	70	Vertical	205x45 Ø	N(F)	p
EVD2-1.5/1432	1.42 - 1.52	2	360	80	Vertical	205x14 Ø	N(F)	
SVD2-1.5V/1657	1.43 - 1.52	2	360	80	Vertical	163x11 Ø	SMA(M)	
SBA-1480/1297	1.43 - 1.52	2	360	80	Vertical	120x22x2	SMA(F)	page 2
SBA-1500-502/445	1.45 - 1.55	2	360	80	Vertical	72x14x126	SMA(F)	p
SVD2-1800-SMA(M)/841	1.70 - 1.88	2	360	80	Vertical	110x6 Ø	SMA(M)	
EVD2-1800/595	1.70 - 1.88	2	360	60	Vertical	191x25 Ø	N(M)	
VOA4-1800/131	1.70 - 1.90	4	360	40	Vertical	405x36 Ø	N(F)	p
VOA4-1800/1319	1.70 - 1.90	4	360	40	Vertical	445x36 Ø	N(F)	p
SBA-1790/1298	1.75 - 1.82	2	360	80	Vertical	105x30x2	SMA(F)	page 2

SBA-1500-502/445

VOA4-1800/131

VOA4-1800/1319

Remote UAV or UGV Platform
Omni and Blade Antennas

Robust, high gain, omni antenna
OA5-3.3L/1402

Robust, omni antenna
EVD2-3.2/1401

Part Number	Frequency GHz	Gain dBi	Beamwidth Azimuth°	Elevation°	Polarisation	Dimensions mm	Connector	Photo p
Antennas - Omni 2GHz to 3GHz								
SVD2-2100/868	2.00 - 2.19	2	360	80	Vertical	106x6 Ø	SMA(M)	p
VOA4-2150/1335	2.00 - 2.25	4	360	40	Vertical	329x36 Ø	N(F)	
SBA-2.3V/1470	2.00 - 2.50	2	360	50	Vertical	89x40x3	SMA(F)	page 3
EVD2-2200/295	2.10 - 2.30	2	360	80	Vertical	175x25 Ø	N(F)	
SBA-2295/1299	2.20 - 2.39	2	360	80	Vertical	90x30x2	SMA(F)	page 2
EVD2-2.3/1406	2.20 - 2.40	2	360	80	Vertical	175x25 Ø	N(F)	p
SVD2-2300/1204	2.20 - 2.40	2	360	80	Vertical	110x10 Ø	SMA(M)	p
VOA10-2340/459	2.28 - 2.38	10	360	10	Vertical	1008x57 Ø	N(F)	
RCO5-2400/195	2.30 - 2.50	5	360	40	Right Circular	344x104 Ø	N(F)	
SVD2-2400/786	2.35 - 2.45	2	360	80	Vertical	109x7 Ø	SMA(M)	
EVD2-2450-D2/631	2.35 - 2.55	2	360	80	Vertical	150x14 Ø	N(F)	p
EVD2-2460-NM/740	2.35 - 2.55	2	360	80	Vertical	170x25 Ø	N(M)	
EVD2-2460/086	2.35 - 2.55	2	360	80	Vertical	170x25 Ø	N(F)	
VOA4-2450-HEL/817	2.40 - 2.50	4	360	40	Vertical	250x70 Ø	N(F)	p
VOA4-2450/184	2.40 - 2.50	4	360	40	Vertical	290x36 Ø	N(F)	
RCO5-2450/156	2.40 - 2.55	5	360	40	Right Circular	346x104 Ø	N(F)	

SVD2-2100/868

EVD2-2.3/1406

SVD2-2300/1204

EVD2-2450-D2/631

VOA4-2450-HEL/817

With helicopter mount for video transmission

EVD2-3.2/1398

Antennas - Omni 3GHz to 4GHz								
EVD2-3.2/1398	3.10 - 3.35	2	360	80	Vertical	123x45 Ø	N(F)	p
EVD2-3.2/1401	3.10 - 3.35	2	360	80	Vertical	150x26 Ø	N(F)	above
OA4-3.2V/1399	3.10 - 3.35	4	360	43	Vertical	300x36 Ø	N(F)	
OA5-3.3L/1402	3.25 - 3.35	5	360	38.5	Left Circular	318x79 Ø	N(F)	above
RCO5-3450-H1/494	3.30 - 3.55	4	360	40	Right Circular	380x104 Ø	N(F)	p
RCO5-3450-MO1/518	3.35 - 3.55	4	360	40	Right Circular	200x140 Ø	N(F)	p
RC010-3450/487	3.35 - 3.55	8	360	12	Right Circular	717x79 Ø	N(F)	
EVD2-3.5/1433	3.40 - 3.50	2	360	80	Vertical	174x13 Ø	N(F)	p
EVD2-3450/225	3.40 - 3.50	2	360	80	Vertical	178x14 Ø	N(F)	p
RCO10-3500/931	3.40 - 3.60	9	360	12	Right Circular	647x79 Ø	N(F)	p
SVD2-3450/426	3.40 - 3.65	2	360	80	Vertical	75x7 Ø	SMA(M)	page 3
VOA4-3450-HEL/237	3.40 - 3.80	4	360	40	Vertical	189x70 Ø	N(F)	
SBA-38/919	3.80 - 4.00	4	360	60	Vertical	112x25x3	SMA(F)	p

RCO5-3450-H1/494

With helicopter mount

RCO5-3450-MO1/518

EVD2-3.5/1433

EVD2-3450/225

RCO10-3500/931

SBA-38/919

Remote UAV or UGV Platform

Omni and Blade Antennas

Control and data links for robotics applications

Part Number	Frequency GHz	Gain dBi	Beamwidth Azimuth°	Elevation°	Polarisation	Dimensions mm	Connector	Photo p
Antennas - Omni 4GHz to 6GHz								
LCO6-4600-D1/908	4.40 - 4.80	6	360	22	Left Circular	342x109 Ø	N(F)	
EVD2-4.7/1471	4.40 - 5.00	2	360	80	Vertical	110x45 Ø	N(F)	
EVD2-47-TNC/1181	4.40 - 5.00	2	360	80	Vertical	120x14 Ø	TNC(F)	
EVD2-4700/1174	4.40 - 5.00	2	360	80	Vertical	120x29 Ø	N(F)	p
EVD2-4700/1334	4.40 - 5.00	2	360	80	Vertical	120x25 Ø	N(M)	
OA6-4.7V/1481	4.40 - 5.00	6	360	23	Vertical	329x38 Ø	TNC(F)	p
VOA6-4.7V/1489	4.40 - 5.00	6	360	24	Vertical	226x32 Ø	N(M)	p
VOA6-47/914	4.40 - 5.00	6	360	23	Vertical	224x31 Ø	N(F)	p
VOA8-47/1170	4.40 - 5.00	8	360	17	Vertical	375x70 Ø	N(F)	p
EVD2-5300/1285	5.15 - 5.45	2	360	80	Vertical	122x26 Ø	N(M)	

EVD2-4700/1174

OA6-4.7V/1481

VOA6-4.7V/1489

VOA6-47/914

VOA8-47/1170

Antennas - Ultra Wideband Omni								
XPO3V-500-1300-LP/586	0.50 - 1.30	2	360	80	Vertical	283x80 Ø	N(F)	
XPO2V-880-2175/1060	0.88 - 2.17	2	360	50	Vertical	221x31 Ø	N(F)	p
XPO2V-1680-2280/140	1.65 - 2.50	2	360	80	Vertical	253x25 Ø	N(F)	
XPO2V-1.0-6.0/1442	1.00 - 6.00	2	360	70	Vertical	134x59 Ø	N(F)	p
XPO2V-2.0-18.0/1397	2.00 - 18.00	2	360	70	Vertical	104x39 Ø	N(F)	p
RCO4-149/1447	14.40 - 15.35	4	360	30	Right Circular	74x69 Ø	TNC(F)	p
RCO4-149/1385	14.40 - 15.35	4	360	30	Right Circular	74x69 Ø	SMA(F)	
RCO4-149/1389	14.40 - 15.40	4	360	40	Right Circular	74x69 Ø	N(F)	

XPO2V-880-2175/1060

XPO2V-1.0-6.0/1442

XPO2V-2.0-18.0/1397

RCO4-149/1447

Ku-band, Common Data Link circular polarised omni

Antennas - Ultra Wideband Directional Planar Spiral								
PSA0218L/1084	2.00 - 18.00	-3(2-4) 2(4-18) 75		75	Left Circular	65x68 Ø	SMA(F)	p
PSA0818L/1045	8.00 - 18.00	4	90	90	Left Circular	21x24 Ø	SMA(F)	p

PSA0218L/1084

Planar spiral antenna to Mil-Spec for helicopters

PSA0818L/1045

Specification Criteria - Link to Ground Station

Antenna for data and telemetry mounted beneath scientific balloon gondola for Swedish Space Corporation

Polarisation Mismatch

The most difficult challenge with a UAV/UGV (unmanned platform) link to a ground station is the polarisation as the link is dependent on the alignment of the unmanned platform.

With linear links, vertical to vertical, or horizontal to horizontal, as a plane banks the signal drops due to polarisation mismatch; it can drop by 25dB in each direction.

The best way to counteract this is to have a circular polarisation match at both ends (right circular to right circular, or left circular to left circular) so that the link budget is maintained irrespective of the position of the antennas.

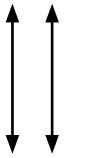
Circular to circular will maintain the link, but the problem is that circular polarisation antennas can have a large diameter and are therefore difficult to mount on an unmanned platform because of weight, size, and lack of aerodynamics.

The best option is to have linear polarisation (usually vertical) on the unmanned platform for wide angle coverage, and circular polarisation on the ground. As long as a 3dB reduction is allowed for in the link budget in calculations to work out platform range, the orientation of the UAV becomes irrelevant as it will work at all angles.

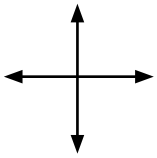
Typical Link Values	dB
Linear / Linear	-60
Linear Vertical / Mismatched Linear	-85
Right Circular / Right Circular	-60
Left Circular / Left Circular	-60
Linear / Circular	-63

"Circular to Linear"

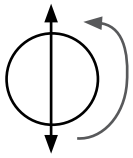
The best option to avoid polarisation mismatch, i.e. poor links, use Linear Vertical Polarisation on the unmanned platform and Circular Polarisation on the ground.



Linear Polarisation Vectors aligned



Linear Polarisation Vectors misaligned



Circular and Linear Polarisation Vectors

What is Polarisation

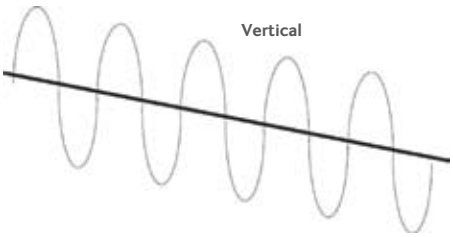
All electromagnetic radiation is polarised. The polarisation of an antenna describes the orientation of its electrical field and can be circular or linear.

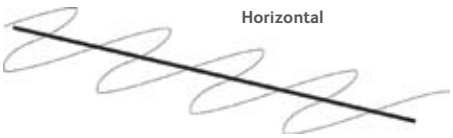
Linear polarisation is usually vertical or horizontal.

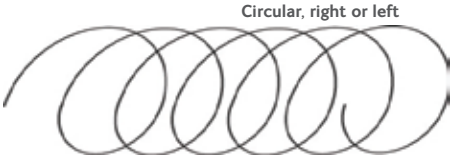
Dual polar antennas can produce vertical and horizontal polarisation via separate ports.

Dual slant antennas are essentially the same as dual vertical and horizontal antennas but with the polarisation rotated by 45°.

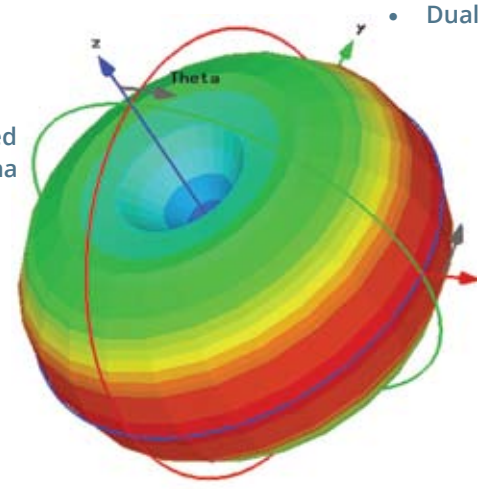
- Vertical
- Horizontal
- Dual Vertical & Horizontal
- Right Circular
- Left Circular
- Dual Circular
- Dual ±45°







Circular polarisation is produced when the E-plane of the antenna spins and depending on the direction of the spin the polarisation is right or left.



3D pattern of dipole antenna

Chelton Limited

Chelton Limited, Lambda House
Cheveley, Newmarket, Suffolk CB8 9RG, UK
T: +44 (0)1638 732177
E: Newmarket.sales@chelton.com

www.chelton.com/microwave